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**Optical Properties of Focused Ion Beam-Induced Plasmonic Ga Nanoparticle Arrays on Compound Semiconductor Surfaces**[1]

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Recently, metallic nanoparticles (NPs) on semiconductor surfaces have enabled the generation of surface plasmon resonances (SPR) which are promising for enhanced light emission, highly-efficient solar cell, ultra-sensitive biosensors, and negative refractive index metamaterials. Ion sputtering-induced surface pattern formation has the potential to become a cost-effective method for achieving metallic NP arrays. Here, we report optical properties of focused ion beam (FIB)-induced plasmonic Ga NP arrays on compound semiconductor surfaces. To date, we have examined SPR energy of FIB-induced Ga NP arrays. The SPR energies increase with decreasing NP or chain diameter, due to particle diameter-dependent dipole interactions within the metallic NPs. We have utilized SPR of FIB-induced Ga NPs for the enhancement of GaAs photoluminescence (PL) efficiency. The maximum PL enhancement occurs for the Ga NP diameter predicted to exhibit a SPR energy corresponding to the GaAs donor-acceptor pair emission energy. When the SPR energy matches the energy of the free carriers in GaAs, it is transferred to the Ga NPs, inducing an enhancement of the spontaneous emission rate. These results suggest that FIB-induced Ga NPs can be a promising alternative plasmonic material.

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